DENTAL TREATING DEVICE

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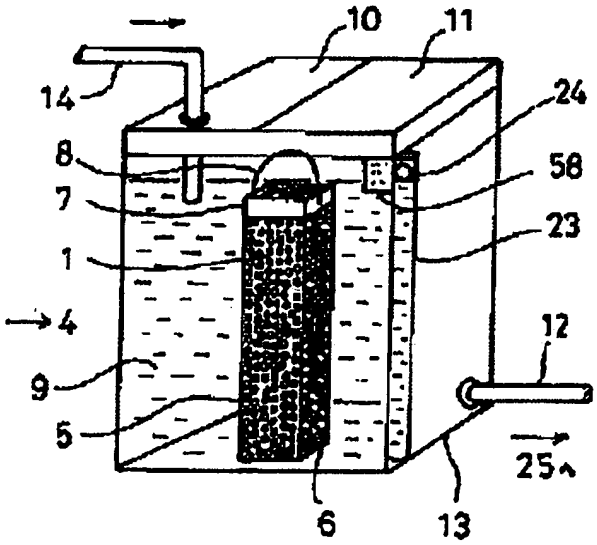
Abstract of **JP2001017452**

PROBLEM TO BE SOLVED: To perform the sterilization of residual water in a water channel and the anticorrosion and anti-degradation of the water channel in a simple mechanism, by arranging an accommodating container for flowingly accommodating antibacterial material for accommodating antibacterial particles coated with antibacterial material on the surface of a granular base material in the water channel in a dental chair unit. SOLUTION: Antibacterial particles 1 comprise a spherical base material and a mineral antibacterial powder adhered to the entire surface, and many antibacterial particles 1 are stacked into an antibacterial particle accommodating container 5 in a silver ion aqueous solution producing device 4 in this dental treating device while a container lid 7 is taken off. A container side mesh 6 makes silver ion aqueous solution freely flow, and a communication pipe 23 having a spherical float 24 is placed at a position observable from the outside in order to observe from outside the water level of set silver ion aqueous solution 9. This silver ion aqueous solution producing device is placed on a dental chair unit.



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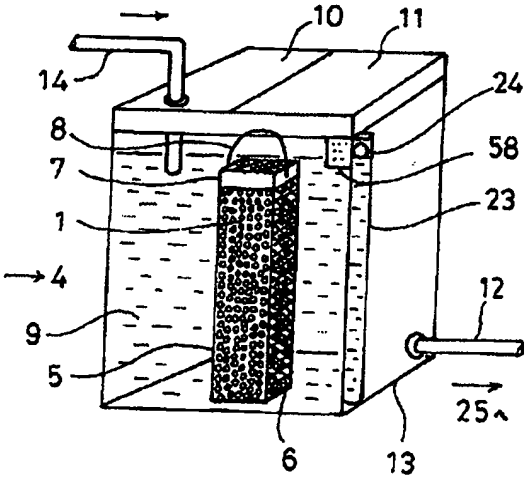
最終頁に続く

(54)【発明の名称】　歯科用治療装置

(57)【要約】
【課題】従来、歯科用チェアユニットの水回路内の残留水や、沪過フィルタの内で細菌が繁殖することがあり、その処理に殺菌用の酸性水等を用いたが、水路の金属類に錆や腐食を生じさせ、また合成樹脂、ゴム系等の関連製品を変形劣化させることがあったため、さらに、水によって洗浄した後管内を乾燥する等していた。これらの課題を解決する手段を提供する。
【解決手段】歯科用チェアユニットの水回路に、粒状の母材の表面に抗菌材が被着されてなる抗菌性粒子を通水可能に収容した通水性抗菌材収容容器を配設し、水回路内残留水の滅菌並びに水回路の防錆等を行う。粒状の母材はプラスチックが好ましく、抗菌材はイオン交換性の金属としての銀を含むゼオライト粉末であることが好ましい。



【特許請求の範囲】

【請求項1】 歯科用チェアユニットの水回路に、粒状の母材の表面に抗菌材が被着されてなる抗菌性粒子を通水可能に収容した通水性抗菌材収容容器を配設したことを特徴とする歯科用治療装置。

【請求項2】 粒状の母材がプラスチックであり、抗菌材がイオン交換性の金属としての銀を含むゼオライト粉末であることを特徴とする請求項1記載の歯科用治療装置。

【請求項3】 粒状の母材が粒径1～10mmのプラスチックであり、抗菌材がイオン交換性の金属としての銀を含む直径0．5～30μmの銀ゼオライト系抗菌剤粉末であることを特徴とする請求項2記載の歯科用治療治療装置。

【請求項4】 銀ゼオライト系抗菌剤粉末が母材としてのプラスチック粒子表面に融着により被着されてなることを特徴とする請求項2又は3に記載の歯科用治療治療装置。

【請求項5】 水道水とその通水により抗菌材収容容器から生成する銀イオン含有洗浄水とを切り換える水回路切換制御器を備えてなることを特徴とする請求項1～4のいずれか1項に記載の歯科用治療装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は歯科用チェアユニットの水回路の処理に係り、特に洗浄水に銀イオン含有水溶液を用いて水回路残留水の滅菌並びに水回路の防錆、劣化防止、消臭等を行う処理に関する。

【0002】

【従来の技術】従来、歯科用チェアユニットにおいて、治療中には患者の口腔内をインスツルメントからの噴流あるいは、シリンジ等により水道水により洗浄しているが、停止時にインスツルメントの先端から水が垂れるのを防止するため吸引を行っており、その際一緒に患者の口腔内の病原菌を吸引し、水回路が汚染される場合があり、また、休診日等でチェアユニットを長時間使用しなかった場合、前記水回路の内の残留水に細菌が繁殖することがあった。さらに、水回路の供給回路に沪過フィルタを設けてある場合、その内部で経時的に細菌が繁殖することがあった。そして上記のため、汚染された洗浄水が患者の口腔内において使用され、患者が感染するというケースがあった。一方、上記の問題に鑑み、歯科用チェアユニットの水回路の残留水の処理に、殺菌のためインスツルメント等の使用後、水回路内に酸性水等を流す場合があるが、前記水回路内に残留することによって、そこに使用されている金属類を経時的に酸化させ、錆や腐食を生じさせることがあり、あるいは合成樹脂系、ゴム系等からなる水管や関連製品を、変形、劣化させるという問題があった。このため、事後に水道水によって酸性水を流して除去し、その後さらに乾燥エアを流して管内を乾燥する等の手続がとられていた。

【0003】

【発明が解決しようとする課題】しかしながら、上記酸性水等を使用する時間は短時間ではあるが、その間に水管内の錆や腐食が行われるとともに、

一般に歯科用チェアユニットの水回路は入り組んだ複雑な経路をもち、その間には複数のジョイント器具等も使用されているため、金属製のものあるいは、樹脂系、ゴム系の製品が使用されている。従って、前記水道水により事後酸性水を洗い流しても酸性水が完全には除去できず、水路内に残留することがあり、徐々に水路内の錆や、腐食、変形、劣化等が進行する場合があった。また、最後に乾燥エアによって管内を乾燥させる一連の作業工程機構は複雑であり面倒であった。そして一度錆たり腐食したり、劣化してしまうと、元の状態への復元は困難であった。本発明では上記水回路の洗浄水に、銀イオン水溶液を用いた簡単な機構によって水回路内残留水の滅菌並びに水回路の防錆、防劣化を行う手段を提供する。

【0004】

【課題を解決するための手段】本発明者等は上記に鑑み鋭意実験研究の結果下記の手段により上記の課題を解決した。

1、歯科用チェアユニットの水回路に、粒状の母材の表面に抗菌材が被着されてなる抗菌性粒子を通水可能に収容した通水性抗菌材収容容器を配設したことを特徴とする歯科用治療装置。

2、粒状の母材がプラスチックであり、抗菌材がイオン交換性の金属としての銀を含むゼオライト粉末であることを特徴とする（1）項記載の歯科用治療装置。

3、粒状の母材が粒径1～10mmのプラスチックであり、抗菌材がイオン交換性の金属としての銀を含む直径0．5～30μmの銀ゼオライト系抗菌剤粉末であることを特徴とする（2）項記載の歯科用治療治療装置。

4、銀ゼオライト系抗菌剤粉末が母材としてのプラスチック粒子表面に融着により被着されてなることを特徴とする（2）項又は（3）項に記載の歯科用治療治療装置。

5、水道水とその通水により抗菌材収容容器から生成する銀イオン含有洗浄水とを切り換える水回路切換制御器を備えてなることを特徴とする（1）項～（4）項のいずれか1項に記載の歯科用治療装置。

【0005】

【発明の実施の形態】銀系抗菌剤の抗菌作用は古くから知られているが、上記抗菌作用とともに、歯科用チェアユニット水回路に使用されている金属に対する防錆・防腐食作用並びに、合成樹脂、ゴム系に対する防劣化・防変形作用、さらに洗浄作用及び消臭作用等の各種の作用を有することに注目し、銀イオン含有水を歯科用チェアユニットの水回路の洗浄水として使用することとした。

本発明の歯科用チェアユニットの水回路に供給される銀イオン含有洗浄水として使用される銀イオン水溶液生成装置は、開示されている（特開平5－176976）抗菌性粒子を水中に投入して生成するもので、上記抗菌性粒子として喜務良工業株式会社製の通称「ドラゴンボール」を使用している。

【0006】抗菌作用の一例として、上記粒状のポリエチレンの母材の表面に被着されている銀イオン交換して担持されたゼオライト抗菌性粒子の一定量を、一定量の水中に入れると、銀イオンが溶出し、銀イオン濃度7．9ppb（μg／kg）の水中では、20分間に大腸菌6．2×10^5cells／mlをO．1%まで殺菌する効果が得られている。また、上記の銀イオン水溶液は生成の過程において、銀イオンの溶出が一定率でかつ、長時間持続することを特徴としている。なお、銀ゼオライト系抗菌剤は、構造式がXM2/nO．Al_2O_3．$YSiO_2$．ZH_2Oであり、XY及びZは係数を示し、MはAgのほかにNa等を示す。

【0007】次に、前記歯科用チェアユニット水回路に使用されている金属に対する防錆・防腐食作用並びに、合成樹脂、ゴム系に対する防劣化・防変形作用、さらに洗浄作用及び消臭作用等の各種の作用金属、樹脂、ゴム等の各素材に対しての防錆作用について説明する。まず、金属については周知のように、金属が電子を放出してイオン化する傾向を表示するイオン化列は、K＞Ca＞Na＞Mg＞Zn＞Fe＞Co＞Pb＞（H）＞Cu＞Ag＞Hg＞Auの順であり、先にあるものほどイオン化傾向が大きく酸化されやすい。したがって、銀（Ag）のイオン化傾向は小さいので、銀イオンを含む溶液に、例えば、亜鉛（Zn）、銅（Cu）、あるいはそれらの合金等の金属を投入すると、銀が金属単体となって析出し、逆に上記亜鉛や銅が亜鉛イオン、銅イオンとなって液に溶け込むイオンの置き換えが行われ、その表面が銀で薄くメッキされる状態となるため防錆効果が生じる。また、前記樹脂、ゴム系統の水管、パッキン等については、前記の銀イオン水溶液のPHは7．2の弱アルカリ性であるため、本来酸化に起因する劣化の要素はなく、また、銀イオンによる薄い皮膜ができるため、例えば可塑材の溶出を防止することができ劣化ひいては変形の防止効果が生じる。

【0008】さらに、周知のように通常の水（水道水）は12ケのクラスターにより構成されているが、銀イオン水においては3ケのクラスターにより構成されており、水に比し1／4と小さいため洗浄効果が大であり、前記水回路内の汚れを容易に洗い流す作用があり、前記各種素材の防錆、劣化等を防止するのに役立っている。

【0009】そして、銀イオンは、アンモニア、ブタン、アミン等に起因する悪臭を前記抗菌作用との相乗効果で強力に分解するため、例えば前記歯科用チェアユニットの水回路の導水管の入り口に設置されたフィルター部分、スピットンの排水トラップ、バキュームタンク等、水が通過滞留する部分から発生する悪臭に対する消臭効果も大である。なお、圧縮エア回路のフィルター部分の消臭効果も同様に行うことができる。

【0010】以上に述べた各作用は、歯科用チェアユニットの水回路は、各種のインスツルメントをはじめ、入り組んだ複雑な水管経路が多く、また、その間には複数のジョイント器具や、パッキン等が使用されているため、その素材である各種の金属、樹脂、ゴム等のが徐々に錆、腐食、劣化、変形等が発生するのを防止し、さらに消臭するのに適している。なお、一般に、上記の素材は、金属は各種ステンレス、黄銅、銅、アルミ等が、樹脂はポリウレタン、ナイロン、塩化ビニール、デルリン、ポリプロピレン、ポリエチレン等が、ゴムはフッ素ゴム、NBR、CR等が、またフィルターには中空糸膜等が使用されている。

【0011】

【実施例】以下図面に基づき実施例を説明する。図1は、抗菌性粒子の拡大外観図、図2は、本発明の歯科用治療装置の銀イオン水溶液生成装置の前面を透視した外観斜視図である。図において、1は抗菌性粒子、2は球状母材、3は無機質抗菌性粉末、4は銀イオン水溶液生成装置、5は抗菌性粒子収容容器、6は容器側面メッシュ、7は容器蓋、8は容器把手、9は銀イオン水溶液、10は生成装置蓋、11は収容器取り出し開口部、12は送出管、13は装置筐体、14は水道水導入管、23は連通管、24は球状フロート、58は設定日記録札、をそれぞれ示す。

【0012】図1に示したように、前述した抗菌性粒子1は球状母材2と、その表面全体に付着されている無機質抗菌性粉末3からなる。実施例では、上記母材2は透明なプラスチック（合成樹脂）で、約3～5mmの直径を有している。無機質抗菌性粉末3はゼオライト固体粉末からなり、平均粒径が2μm、比重が2．1～2．2を有している。またこの無機質抗菌性粉末3は100gの母材2に対し約3gの割合で被着されている。上記ゼオライト固体粉末は、例えばアルミノシリケートよりなる天然又は合成ゼオライトが銀イオン交換して担持されている。

【0013】図2の前面を透視した外観斜視図に示したように、まず、本発明の歯科用治療装置の銀イオン水溶液生成装置4には、上記抗菌性粒子1の多数個を、抗菌性粒子収容容器5に容器蓋7をとって積層して入れる。また容器側面メッシュ6は、銀イオン水溶液を自由に流通させるものである。また、前記の銀イオン濃度に設定するには、例えば、上記収容器5の容積は、所要銀イオン水溶液生成装置4の、1リットル当たり約1g～5gの前記抗菌性粒子1が収容できる容積とする。また、例えば一台の歯科用チェアユニットにおいて、水回路の残留水処理に要する総量を約10リットル／1日とする

と、銀イオン水溶液生成装置４の容積を１０リットルとし、抗菌性粒子収容容器５の容積は抗菌性粒子１が１０ｇ収容できる容積とすれば、１日のサイクルで常用することができる。また、本発明の銀イオン水溶液は、有効期間が約６ケ月と長期であり経済的に使用できるとともに、新しい材料に交換することも容易である。そして、設定日記録札５８を備えることにより、経過日数を明確に把握することができる。

【００１４】さらに、前記銀イオン水溶液９の水位を外部から観測するため、球状フロート２４を浮かせた連通管２３を、外部から見える位置に配設して観測できるようにしている。なお、水位の観測には前記連通管２３内の、形を特定しないフロートを、電気回路を用いて、光や磁気によって非接触で計測し表示するようにしてもよく、それと連動して水位が低いときには注水栓を開き注水するようにしてもよい。

【００１５】本装置にて生成される銀イオン水溶液は前述したように、前記の濃度では、その滅菌作用は遅効性であるが、通常水回路の残留水は滞留時間が長いため前記の殺菌効果及び防錆、防腐食、防劣化・変形、消臭の各作用が発揮される。一方、銀イオン水溶液は無色透明、無味、無臭でかつ人体に対しては無害であり、誤って嚥下しても弱アルカリイオン水としての効果をもつため、インスツルメントの洗浄液として常時使用することが可能であり、また口腔のうがい用にも適している。

【００１６】図３は本発明の銀イオン水溶液生成装置を配設した歯科用チェアユニットの外観図で、図４は、注水付きハンドピースの外観図、である。図において、２５は歯科用チェアユニット、２６はチェア、２７はブラケットテーブル、２８はメイン側インスツルメント群、２９はサブ側インスツルメント群、３０はスピットン、３１はコップ給水管、３２はスピットン洗浄管、３３はハイドロコロイド給水管、３４は台座、３５はフットスイッチ、３６はライト、３７は注水付きハンドピース、３８は注水、３９は回転ドリル、４０は銀イオン水溶液生成装置の収容筐体を示す。

【００１７】図３は、銀イオン水溶液生成装置４を収容筐体４０に収容し、歯科用チェアユニット２５の外部に付設して構成した事例であり、洗浄水は全て前記銀イオン水溶液を用いている。なお、上記中のインスツルメント群２８、２９及びスピットン３０、コップ給水管３１、スピットン洗浄管３２、ハイドロコロイド給水管３３等の各水回路の作用については後述する。また、上記の銀イオン水溶液生成装置４は、チェアユニット２５に内蔵してもよい（図示せず）。図４はインスツルメント群の中の、注水付きハンドピース（ＡＴ：エアータービン）３７の事例で、先端部の回転ドリル３９の下方周辺穴から注水３８される。また、基部で供給用ホースに着脱できるようになっている。

【００１８】図５は、銀イオン水溶液生成装置に水回路切替制御器を並設した外観図、である。図において、１５は水道水導入管、１６は水回路切換制御器、１７、１８は回路表示ランプ、１９は切り換え用つまみ、２０は導水時間設定器、２１は制御器筐体、２２は送出管を示す。水回路切換制御器１６は、水道水導入管１５並びに銀イオン水送出管１２の２本の水管を有し、パネル面の切り換え用つまみ１９によって内部で、水道水又は銀イオン水のいずれかに切り替えられ、回路表示ランプ１７あるいは１８を点灯表示する。そして、送出管２２から導出方向矢印のように前記チェアユニット２５へ供給される。また、導水時間は導水時間設定器２０により所要時間が設定される。この水回路切換制御器１６は、洗浄水を少量使用するインスツルメント群と、洗浄水を多量に使用するスピットン等の他の水回路とを分離することにより、銀イオン水溶液を効率よく使用する（後記）ことができる。

【００１９】次に、本発明の歯科用治療装置のブロック図に基づいて作用を説明する。図６は、歯科用チェアユニットの全水回路に銀イオン水溶液の洗浄水を使用したブロック図である。図において、１４は導入管、１４ａは電磁弁、１４ｂは開閉スイッチ、４１は給水ポンプ、４２は吸引ポンプ、４３はコップ給水、４４はスピットン、４５はスリーウエイシリンジ、４７はバキュームシリンジ、４８はサライバエジェクタ、４９はスケーラ、５０はマイクロモータハンドピース、５１、５２はエアータービンハンドピース、３１ａ～３３ａは電磁弁、３１ｂ～３３ｂは開閉スイッチ、及び４５ａ、４７ａ～５２ａは電磁弁、４５ｂ、４７ｂ～５２ｂは開閉スイッチ、５３はメイン側ハンドピース排水路、５４はサブ側ハンドピース排水路、５５は排水元管、５６はサブ側、５７はメイン側、５９はフィルター、６０は排水タンク、６１吸水用容器、６２は排水用容器、６４は電磁弁、をそれぞれ示す。

【００２０】水道水は、フィルタ５９と開閉スイッチ１４ｂによる電磁弁１４ａ及び水道水導入管１４を経由して洗浄水生成装置４に導入され、前記洗浄水（銀イオン水溶液）が生成される。そして、送出管１２より歯科用チェアユニット２５（図３）の水回路に、給水ポンプ４１とフットスイッチ３５の開閉駆動により電磁弁６４を経由して供給される。この洗浄水は、メイン側５７のブラケットテーブル２７（図３）に搭載されているインスツルメント群２８（スリーウエイシリンジ４５、スケーラ４９、マイクロモータハンドピース５０、エアータービンハンドピース５１、５２、の水回路並びに、サブ側５６のブラケットテーブル５６（図３）に搭載されているインスツルメント群２９（スリーウエイシリンジ４５及び、吸引排水用のバキュームシリンジ４７、サライバエジェクタ４８）の各水回路に供給され、そして、上記各インスツルメン洗浄後の排水は、コップ給水４３、スピットン４４あるいは排水用容器６２等から排水元管５５

に流される。また、上記吸引排水用のバキュームシリンジ47、サライバエジェクタ48の洗浄水は、前記洗浄水を吸水用容器61に一旦貯留し、そこから吸引洗浄し排出する。

【0021】そして、前記インスツルメント群の水回路の他の、ハイドロコロイド給水管33、コップ給水43、スピットン44等の排水用の水回路にも、それぞれ洗浄水を供給し、排水元管55から排水タンク60吸引ポンプ42を径て排水される。電磁弁(14a、31a～33a、45a、47a～52a)は、開閉スイッチ(14ba、31b～33b、45b、47b～52b)に、連動しており、上記各開閉スイッチによって電磁弁が作動する。この電磁弁が作動した状態の時、送出管12の電磁弁64をフットスイッチ35で開閉駆動し、前記の各水回路に洗浄水を供給する。

【0022】図7は、銀イオン水溶液生成装置に水回路切替制御器を並設したブロック図である。この水回路切替制御器16は、洗浄水を少量使用するインスツルメント群と、洗浄水を多量に使用するスピットン等の他の水回路とを分離することにより、銀イオン水溶液を効率よく使用するため配設されたものである。図において、19a、19b、19cは電磁弁、19a'、19b'、19c'は連動開閉スイッチを示す。前記水回路切換制御器16は、水道水導入管15、並びに銀イオン水の送出管12の2本の水管を有し(図5)、パネル面の切り換え用つまみ19によって内部で、水道水又は銀イオン水のいずれかに切り替えられ、この時回路表示ランプ17あるいは18が点灯表示される(図5)。そして、送出管22から前記チェアユニット25へ供給される。また、各導水時間は、導水時間設定器20により設定され、所要時間が設定される。

【0023】上記水回路切換制御器16は、切り換え用つまみ19(図5)によって切り替えられる19a'、19b'、19c'の3つの水管切り替え用の連動開閉スイッチと、それによって駆動される電磁弁19a、19b、19cを作動させ、その組み合わせによって、洗浄水を少量使用するインスツルメント群(スケーラ49、マイクロモータハンドピース50、エアータービンハンドピース51、52)の水回路と、洗浄水を多量に使用するスピットン等の他の水回路(スリーウエイシリンジ45、ハイドロコロイド給水管33、コップ給水43、スピットン44)等の排水用とに分離し、常時(診療時)には、洗浄水生成装置4からの洗浄水は上記洗浄水を少量使用するインスツルメント群のみに供給し、洗浄水を多量に使用するスピットン等の他の水回路には、水道水を供給する。なお、吸引排水用のバキュームシリンジ47、サライバエジェクタ48の水回路は、他の水回路の分類に入る。そして、上記、他の水回路には、診療後に前記導水時間設定器20により一定時間を限って、銀イオン水溶液生成装置4からの洗浄水が供給される。上記の組み合わせによって、銀イオン水溶液生成装置4の容積は小さくて済み、歯科用チェアユニット25に内蔵させることも容易となるとともに、銀イオン水溶液を効率よく使用することができる。

【0024】

【発明の効果】本発明によれば下記のような優れた効果が発揮される。簡単な機構により水回路内残留水の滅菌並びに水回路の防錆、防劣化、防変形効果及び水回路の防臭効果等の総合的効果を得ることができる。また、水道水と銀イオン水溶液生成装置からの洗浄水とを切り換える水回路切換制御器を備えたものにあっては、洗浄水を少量使用する水回路には常時供給し、その他の大量使用の水回路には、常時は水道水を供給し、診療後の一定時間のみ前記銀イオン水溶液の洗浄水を供給することができ、効率よく使用することができる。

【図面の簡単な説明】

【図1】抗菌性粒子の拡大外観図。

【図2】本発明の歯科用治療装置の銀イオン水溶液生成装置の前面を透視した外観斜視図。

【図3】本発明の銀イオン水溶液生成装置を配設した歯科用チェアユニットの外観図。

【図4】注水付きハンドピースの外観図。

【図5】銀イオン水溶液生成装置に水回路切替制御器を並設した外観図。

【図6】歯科用チェアユニットの全水回路に銀イオン水溶液の洗浄水を使用したブロック図。

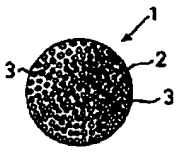
【図7】銀イオン水溶液生成装置に水回路切替制御器を並設したブロック図。

【符号の説明】

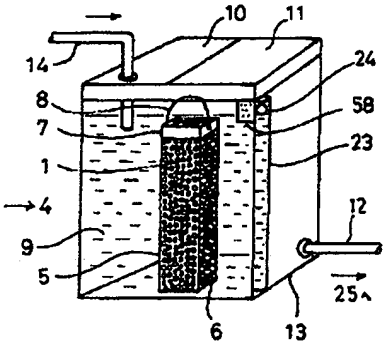
1:抗菌性粒子	2:球状母材
3:無機質抗菌性粉末	4:銀イオン水溶液生成装置
5:抗菌性粒子収容容器	6:容器側面メッシュ
7:容器蓋	8:容器把手
9:銀イオン水溶液	10:生成装置蓋
11:収容器取り出し開口部	12:送出管
13:装置筐体	14:水道水導入管
14a:電磁弁	14b:開閉スイッチ
15:水道水導入管	16:水回路切換制御器
17、18:回路表示ランプ	19:切り換え用つまみ
20:導水時間設定器	21:制御器筐体
22:送出管	23:連通管
24:球状フロート	25:歯科用

チェアユニット
26：チェア　27：ブラケ
ットテーブル
28：メイン側インスツルメント群　29：サブ側
インスツルメント群
30：スピットン　31：コップ
給水管
31a～33a：電磁弁　31b～33
b：開閉スイッチ
32：スピットン洗浄管　33：ハイド
ロコロイド給水管
34：台座　35：フット
スイッチ
36：ライト　37：注水付
きハンドピース
38：注水　39：回転ド
リル
40：銀イオン水溶液生成装置収容筐体　41：給水ポ
ンプ
42：吸引ポンプ　43：コップ
給水
44：スピットン　45：スリー
ウエイシリンジ
45a～52a：電磁弁　45b～52
b：開閉スイッチ
47：バキュームシリンジ　48：サライ
バエジェクタ
49：スケーラ　50：マイク
ロモータハンドピース
51、52：エアタービンハンドピース
53：メイン側ハンドピース排水路　54：サブ側
ハンドピース排水路
55：排水元管　56：サブ側
57：メイン側　58：設定日
記録札
59：フィルター　60：排水タ
ンク
61：吸水用容器　62：排水用
容器

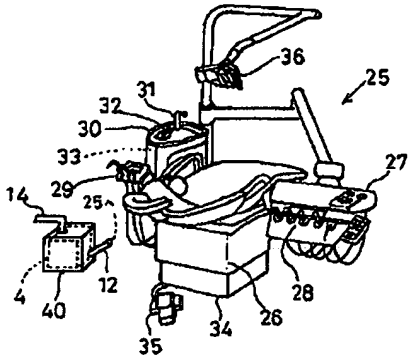
【図1】



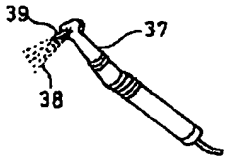
【図2】



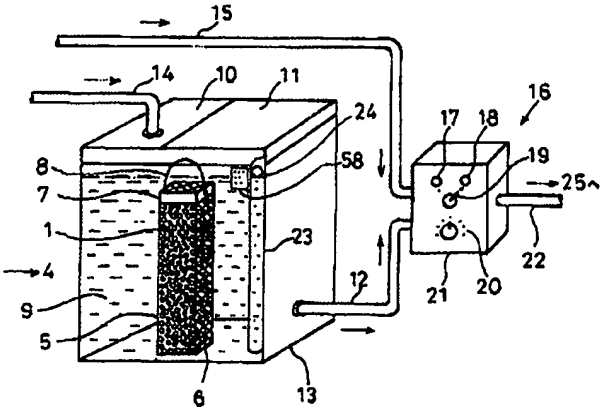
【図3】



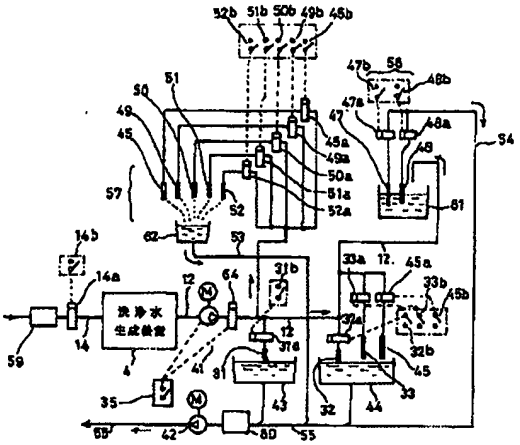
【図4】



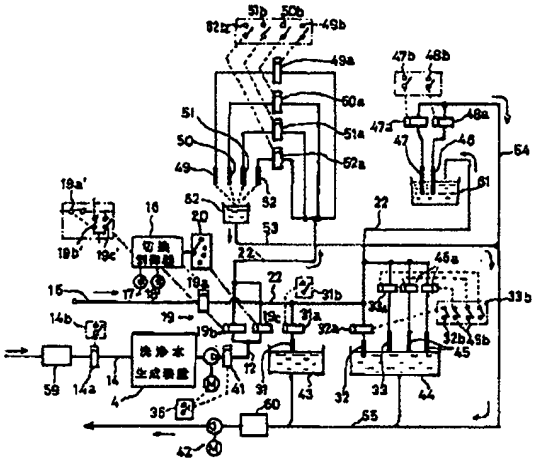
【図5】



【図6】



【図7】



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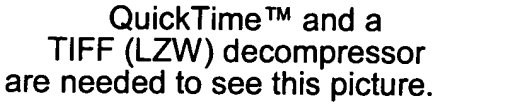
(54) [Title of Invention] Dental treatment device

(57) [Abstract]

[Problem] In the past, bacteria would propagate in the reservoir water and in the filter inside the water circuit of a dental chair unit, and acidic antibacterial solutions, etc. were used to treat this, but since this would cause rusting and corrosion of the metal in water circuit, and/or deformation and degeneration of related synthetic resin or rubber, etc. products, it would be further necessary to rinse the inside of the pipes with water and then dry it. This will provide a means of solving these problems.

[Solution] A water-permeable antibacterial material containment vessel containing antibacterial grains, in which the surface of a granular medium is coated with an antibacterial material, such that water can pass through, is disposed in the water circuit of a dental chair unit, to disinfect the reservoir water inside the water circuit and to prevent rusting, etc. of the water circuit. It is preferred that the granular medium is plastic and it is preferred that the antibacterial material is zeolite powder that contains silver as an ion-exchange metal.



To 25

[Claims]

[Claim 1] A dental treatment device that is characterized in that a water-permeable antibacterial material containment vessel containing antibacterial grains, in which the surface of a granular medium is coated with an antibacterial material, such that water can pass through, is disposed in the water circuit of a dental chair unit.

[Claim 2] The dental treatment device disclosed in claim 1, characterized in that the granular medium is plastic and the antibacterial material is zeolite powder that contains silver as an ion-exchange metal.

[Claim 3] The dental treatment device disclosed in claim 2, characterized in that the granular medium is plastic grains with a grain size of 1 to 10 mm and the antibacterial material is silver zeolite antibacterial powder with a grain size of 0.5 to 30μm that contains silver as an ion exchange metal.

[Claim 4] The dental treatment device disclosed in claim 2 or 3, characterized in that the silver zeolite antibacterial powder is applied to the surface of the plastic granular medium by melt fusion.

[Claim 5] The dental treatment device disclosed in any of claims 1 through 4, characterized in that it is equipped with a water circuit switching controller that switches between tap water and silver ion-containing rinse water produced by passing said tap water through the antibacterial material containment vessel.

[Detailed Description of the Invention]

[0001]

[Pertinent Technical Field] This invention pertains to the treatment of the water circuit in a dental chair unit, and more specifically pertains to treatment that uses a silver ion-containing aqueous solution as a rinse water to disinfect reservoir water in the water circuit and to prevent rusting, prevent deterioration, and deodorize, etc. the water circuit.

[0002]

[Prior Art] In dental chair units, the inside of the patient's mouth conventionally was rinsed with tap water using a jet stream from an instrument or a syringe, etc., but suction was applied to prevent water from dripping from the tip of the instrument when spraying was stopped, in which case, pathogens in the patient's mouth were sometimes sucked up with the water and contaminated the water circuit, or when chair unit was not used for long periods, as on weekends, etc., bacteria would propagate in the reservoir water in the aforementioned water circuit. Furthermore, if a filter were disposed in the supply circuit of the water circuit, bacteria would propagate inside the filter over time. Due to the above, there were cases in which the inside of the patient's mouth would be rinsed with contaminated water, infecting the patient. Meanwhile, in order to address the aforementioned problems, after using an instrument, etc. the inside of the water circuit would be purged with sterilizing acidic water, etc. to treat the reservoir water in the water circuit of the dental chair unit, but was problematic as the acidic water would then remain inside the aforementioned water circuit, oxidizing the metals used therein over time and causing rust and corrosion, or deforming and deteriorating the synthetic resin or rubber water pipes and related goods. Therefore, procedures were adopted in which the acidic water subsequently would be flushed out with tap water, and then the insides of the pipes would be dried by blowing dry air.

[0003]

[Problems to be Solved by the Invention] However, while the time that the aforementioned acidic water, etc. is used is a short time, rust and corrosion do occur in the water pipes during

that time, and since the water circuit in a typical dental chair unit is an assembly of complex passages, along which complicated articulated implements are used, metal or resin or rubber components are used. Consequently, even if the subsequent acidic water is rinsed out with the aforementioned tap water, the acidic water may not be able to be completely removed, and may remain in the water circuit, and rusting, corrosion, deformation, and degradation of the water circuit will in some cases gradually progress. In addition, the sequence of procedures and mechanisms required finally to dry in the insides of the pipes with dry air are complex and troublesome. Furthermore, once rust, corrosion, and degradation have begun, it is difficult to restore things to their original condition. This invention provides means whereby reservoir water in the water circuit can be sterilized, and rust and degradation of the water circuit can be prevented, by means of a simple mechanism using a silver ion water solution as the water for rinsing the aforementioned water circuits.

[0004]

[Means of Solving Problems] As the result of earnest testing and research addressing the above, the inventors have solved the aforementioned problems by the following means.

1. A dental treatment device that is characterized in that a water-permeable antibacterial material containment vessel containing antibacterial grains, in which the surface of a granular medium is coated with an antibacterial material, such that water can pass through, is disposed in the water circuit of a dental chair unit.

2. The dental treatment device disclosed in (1), characterized in that the granular medium is plastic and the antibacterial material is zeolite powder that contains silver as an ion-exchange metal.

3. The dental treatment device disclosed in (2), characterized in that the granular medium is plastic grains with a grain size of 1 to 10 mm and the antibacterial material is silver zeolite antibacterial powder with a grain size of 0.5 to 30μm that contains silver as an ion exchange metal.

4. The dental treatment device disclosed in (2) or (3), characterized in that the silver zeolite antibacterial powder is applied to the surface of the plastic granular medium by melt fusion.

5. The dental treatment device disclosed in any of (1) through (4), characterized in that it is equipped with a water circuit switching controller that switches between tap water and silver ion-

containing rinse water produced by passing said tap water through the antibacterial material containment vessel.

[0005]

[Conditions of Embodiment of the Invention] The antibacterial action of silver antibiotics has long been known, but focusing on the facts that it also has a variety of other actions in addition to the aforementioned antibacterial action, such as antirust and anticorrosive action on the metals used in dental chair unit water circuits, and degradation and deformation preventive action on synthetic resins and rubber, as well as cleaning and deodorizing action, silver ion-containing water is used as a rinse water for the water circuits in dental chair units. The device that produces the silver ion water solution used as the silver-ion containing rinse water supplied to the water circuits in the dental chair unit of this invention is the device in which disclosed antibacterial granules (Japan Kokai Patent Application No. H5-176976) are placed in water and produce silver ion water solution, and using the Kimuro Kogyo K.K. product "Dragon Balls" as the aforementioned antibacterial granules.

[0006] As an example of antibacterial action, when a set quantity of zeolite antibacterial granules, held by silver ion exchange and applied to the surface of the aforementioned granular polyethylene medium, are placed in a set quantity of water, the silver ions are dissolved, yielding efficacy in which 6.2×10^5 cells/mL are eradicated in 20 minutes to 0.1% in water with a silver ion concentration of 7.9 ppb (μg/kg). The process of producing the aforementioned silver ion water solution is also characterized by the dissolution of silver ions continuing at a constant rate for a long period. Further, structural formula of the silver zeolite antibacterial agent is $XM2/nO{\cdot}Al_2O_3{\cdot}YSiO_2{\cdot}ZH_2O$, wherein X, Y, and Z represent coefficients, and M represents Ag or Na, etc.

[0007] Next, the anti-rust and anticorrosive action on the metals, the anti-deterioration and anti-deformation action, and the cleansing action and deodorizing action, on the synthetic resins and rubbers, and used in the aforementioned dental chair unit water circuit will be explained. First, as is well known, examples of ionization in metals that show a tendency to release electrons and ionize occur in the sequence K>Ca>Na>Mg>Zn>Fe>Co>Pb>(H)>Cu>Ag>Hg>Au, with the tendency for ionization being greater, and oxidation being easier, toward at the beginning of the sequence. Consequently, since silver (Ag) shows a low tendency to ionize, when metals, e.g., zinc (Zn), copper (Cu), or alloys thereof, etc., are placed in solutions containing silver ions, the

silver becomes a metal monomer and precipitates, while the aforementioned zinc or copper are conversely dissolved into the solution as zinc ions or copper ions and ion replacement occurs, whereby the surfaces are thinly plated with silver, to produce an antirust effect. As for the resins and rubber water pipes and gaskets, etc., since the pH of the aforementioned silver ion water solution is weakly alkaline at 7.2, there are essentially none of the elements of degradation that are caused by oxidation, and since a thin cladding film is formed by the silver ion, dissolution of the plastic components, for example, can be prevented, causing an effect that prevents degradation and the resultant deformation.

[0008] Furthermore, as is commonly known, normal water (tap water) is constituted of 12 clusters, but silver ion water is constituted of 3 clusters, making it ¼ as large as water and giving it substantial cleaning effect, providing action in which dirt inside the aforementioned water circuits is easily rinsed out, which plays a role in preventing rusting and deterioration, etc. of the various types of components.

[0009] Additionally, silver ions, in cumulative effect with the aforementioned antibacterial action, intensely break down offensive odors caused by ammonia, butane, and amines, etc., and therefore have substantial deodorizing effect against odors generated from areas in which water passes or is stored, e.g., the area of the filter disposed at the tap water inlet of the water circuit, the spit sink drain trap, or the vacuum tank, etc., in the aforementioned dental chair unit. Further, similar deodorizing effect is accomplished in the area of the filter in the compressed air circuit.

[0010] Since the water circuits in a dental chair unit comprise complicated built-in water plumbing, starting from the various instruments, using complex articulated joints and gaskets, etc., between the various pipes, the various actions described above are suited to preventing the gradual rusting, corrosion, degradation, deformation, etc., as well as deodorizing, of the various metal, resin, and rubber materials used therein. Further, commonly used raw materials are, for metals, various stainless steels, brass, copper, aluminum, etc., for resins, polyurethane, nylon, vinyl chloride, deruline, polypropylene, polyethylene, etc., and as rubber, fluorine rubbers, NBR, and CR, and as the filter, hollow films, etc.

[0011]

[Example Embodiments] Example embodiments will be explained based on the attached figures. Figure 1 is a magnified external view of an antibacterial granule, and Figure 2 is an oblique external view of the silver ion water solution-producing device of the dental treatment

device of this invention, seen through the front surface. In the figures, 1 is an antibacterial granule, 2 is a spherical medium, 3 is an inorganic antibacterial powder, 4 is a silver ion water solution producing device, 5 is an antibacterial granule containment vessel, 6 is a vessel side mesh, 7 is a vessel tank, 8 is a vessel handle, 9 is a silver ion water solution, 10 is a production device tank, 11 is a containment vessel removal port, 12 is a feed pipe, 13 is a device box, 14 is a tap water inlet pipe, 23 is a communicating pipe, 24 is a ball float, and 58 is a setup log sheet.

[0012] As shown in Figure 1, the antibacterial granule described above is made from a spherical medium 2 and the inorganic antibacterial powder 3 adhered to its entire surface. In this example embodiment, the aforementioned medium 2 is transparent plastic (synthetic resin) with a diameter of approximately 3 to 5 mm. The inorganic antibacterial power 3 comprises zeolite solid powder, with a mean grain size of 2 μm and specific gravity of 2.1 to 2.2. In addition, this inorganic antibacterial powder 3 is applied at a ratio of approximately 3 gm per 100 gm of medium 2. The aforementioned zeolite solid powder is held by the silver ion exchange of a natural or synthetic zeolite made, e.g., from aluminosilicate.

[0013] As shown by the external oblique view drawing, viewed through the front surface, in Figure 2, first, a multiplicity of the aforementioned antibacterial granules 1 is packed into the vessel tank of the antibacterial granule containment vessel 5 in the silver ion water solution producing device 4 of the dental treatment device of this invention. In addition, a vessel side mesh 6 allows the aforementioned silver ion water solution to freely flow through. Additionally, to set the aforementioned silver ion concentration, e.g., the capacity of the aforementioned containment vessel 5 is set to accommodate approximately 1 gm to 5 gm of the aforementioned antibacterial granules 1 per one liter in the designated silver ion water solution-producing device 4. Assuming that a total of approximately 10 liters/day reservoir water must be processed in the water circuits of one dental chair unit, and that the capacity of the silver ion water solution producing device 4 is 10 liters, if the capacity of the antibacterial granule containment vessel 5 is 10 gm of antibacterial granules 1, then they can be constantly used on a one-day cycle. The silver ion water solution of this invention has a long expiration period of approximately 6 months, and replacement with new material is simple. Further, by providing a setup log sheet 58, the numbers of days left can be easily discerned.

[0014] Furthermore, a connecting pipe 23 with a ball float 24 floating in it is disposed at a position that can be seen and monitored from the outside so that the level of the aforementioned

silver ion water solution can be monitored from the outside. Further, the level inside the aforementioned communicating tube 23 may also be monitored using a float of an unspecified shape, or measured and displayed using an electrical circuit or a non-contact means such as light or magnetic, which would operate to detect when the level is low, and open a supply water valve to supply water.

[0015] The sterilizing action of the silver ion water solution produced in this device, as discussed above, is delayed at the aforementioned concentration, but since reservoir water is normally left in the water circuit for a long time, the aforementioned bactericidal effect and antirust, anticorrosion, anti-degradation and deformation, and deodorization actions can be realized. Meanwhile, the silver ion water solution is colorless and transparent, flavorless, and odorless, and is harmless to humans, and only has the effect of a weak alkaline ion water it is accidentally swallowed, it can always be used as a rinse water for instruments, and is even suited to use as an oral rinse.

[0016] Figure 3 is an external view drawing of a dental chair unit in which the silver ion water solution-producing device of this invention has been installed, and Figure 4 is an external view drawing of a water-jet handpiece. In these figures, 25 is the dental chair unit, 26 is a chair, 27 is a bracket table, 28 is the main instrument group, 29 is a sub-instrument group, 30 is a spit sink, 31 is a cup supply pipe, 32 is a spit sink rinse pipe, 33 is a hydrocolloid supply pipe, 34 is a base, 35 is a foot-switch, 36 is a light, 37 is a water-jet handpiece, 38 is a water jet, 39 is a rotary drill, and 40 is a silver ion water solution producing device containment box.

[0017] Figure 3 is an example constituted with the silver ion water solution producing device 4 accommodated in a container box 40, which is mounted on the outside of the dental chair unit 25, and the aforementioned silver ion water solution is used for all cleaning. Further, the actions of the various water circuits for the instrument groups 28, 29, spit sink 30, cup supply pipe 31, spit sink rinse pipe 32, and hydrocolloid supply pipe, etc. will be explained later. In addition, the aforementioned silver ion water solution-producing device 4 may be built into the chair unit 25 (not shown). Figure 4 is an example of the water-jet handpiece (AT: air turbine) 37, which sprays water 38 from a hole below and near the rotary drill 39 at its tip. It is also constructed so that it can be attached and removed from a supply hose at its base.

[0018] Figure 5 is an external-view drawing of the water circuit switching controller connected to the silver ion solution producing device. In this figure, 15 is a tap water inlet pipe, 16 is a

water circuit switching controller, 17 and 18 are circuit indicator lamps, 19 is a switching knob, 20 is water supply timer, 21 is a controller case, and 22 is a inlet/outlet pipe. The water circuit switching controller 16 possesses two water pipes, the tap water inlet pipe 15 and the silver ion water inlet/outlet pipe 12, and internally switches between either tap water or silver ion water, and lights the circuit indicator lamps 17, 18 according to the switching knob 19 on its panel. The aforementioned chair unit is then supplied from the inlet/outlet pipe 22 as indicated by the inlet/outlet arrows. The water inlet time is set to the desired time with the inlet timer 20. By separating instrument group, which uses small quantities of rinse water, from the spit sink, which uses large quantities of rinse water, this water circuit switching controller 16 makes it possible to efficiently use the silver ion water solution.

[0019] Next, the action of the dental treatment device of this invention will be explained based on a block diagram. Figure 6 is a block diagram in which silver ion water solution cleanser is used in all the water circuits of the dental chair unit. In the figure, 14 is an inlet pipe, 14a is a solenoid valve, 14b is a open/close switch, 41 is a water supply pump, 42 is a vacuum pump, 43 is cup supply water, 44 is a spit sink, 45 is a three-way syringe, 47 is a vacuum syringe, 48 is a saliva ejector, 49 is a scaler, 50 is a micromotor handpiece, 51 and 52 are air turbine handpieces, 31a-33a are solenoid valves, 31b-33b are open/close switches, 45a, 47a-52a are solenoid valves, 45b, 47b-52b are open/close switches, 53 is a main handpiece drain water circuit, 54 is a sub handpiece drain water circuit, 55 is the main drain pipe, 56 is the sub-side, 57 is the main-side, 59 is a filter, 60 is a drain water tank, 61 is a water suction container, 62 is a drain water container, and 64 is a solenoid valve.

[0020] Tap water introduced to the rinse water producing device 4 via the solenoids valve 14a and the tap water inlet pipe 14 via the filter 59 and open/close switch 14b, where the aforementioned rinse water (silver ion water solution) is produced. This is then supplied by the feed pipe 12 to the water circuit in the dental chair unit 25 (Figure 3) via the solenoid valve 64 by opening and closing the supply pump 41 and footswitch 35. This rinse water is supplied to the various water circuits in the instrument group 28 (water circuits of the three-way syringe 45, scaler 49, micromotor handpiece 50, and air turbine handpieces 51, 52) mounted on the main-side 57 bracket table 27 (Figure 3), and to the various water circuits in the instrument group 29 (three-way syringe 45, suction drain vacuum syringe 47, and saliva ejector 48) mounted on the sub-side 56 bracket table 56, and the waste water after cleaning the various aforementioned

instruments flows from the spit bowl 44 or the waste water vessel 62, etc. to the main drain pipe 55. In addition, the aforementioned rinse water in the aforementioned suction discharge vacuum syringe 47 and saliva ejector 48 is temporarily stored in the suction water container 61, which is later vacuum-cleaned and drained.

[0021] In addition to the water circuits of the aforementioned instrument groups, rinse water is also supplied to the waste water circuits of the hydrocolloid supply pipe 33, the cup water supply 43, and the spit sink 44, etc., and is then drained from the main waste water pipe 55 via the suction pump 42 of the waste water tank 60. The solenoid valves (14as, 31a-33a, 45a, 47 a-52a) are actuated by open/close switches (14b, 31b-33b, 45b, 47b-52b), and each of the aforementioned open/close switches operates a solenoid valve. When a solenoid valve is in the actuated state, the solenoid valve 64 of the feed pipe 12 is driven to open/closed by the footswitch 35, supplying rinse water to the various aforementioned water circuits.

[0022] Figure 7 is a block diagram in which a water circuit switching controller is installed in the silver ion water solution producing device. This water circuit switching controller 16 is provided so that the silver ion water solution is efficiently used by separating the instrument group that uses small amounts of rinse water from the instrument group that uses large amounts of rinse water. In the figure, 19a, 19b.and 19c are solenoid valves, and 19a', 19b', and 19c' are open/close actuator switches. The aforementioned water circuit switching controller 16 possesses two water pipes, viz., the tap water inlet pipe 15 and a silver ion water feed pipe 12, (Figure 5), and the tap water and silver ion water are internally switched by means of a switching knob 19 on the front panel, at which time, a circuit indicator lamp 17 or 18 is lit (5). Tap water or rinse water is then supplied to the aforementioned chair unit 25 from the feed pipe 22. In addition, the time that water is introduced in each case is set to the desired time by means of a water supply timer 20.

[0023] Through a combination of three water-switching actuator open/close switches 19a', 19b', 19c' switched by the switching knob 19 (Figure 5) and the solenoid valves 19a, 19b, 19c, which are driven by them, the aforementioned water circuit switching controller 16 separates water circuits of the instrument group that use small quantities of rinse water (scalar 49, micromotor handpiece 50, air turbine handpieces 51, 52) from the waste water for the other water circuits of the spit sink, etc. that use large quantities of rinse water (three-way syringe 45, hydrocolloid supply pipe 33, cup water supply 43, spit sink 44), always (during treatment) supplying the

aforementioned rinse water from the rinse water producing device 4 only to the instrument group that uses the small quantities of rinse water, and supplying tap water to the other water circuits, such as the spit sink, etc., that use large quantities of rinse water. Further, the water circuits of the suction discharge vacuum syringe 47 and saliva ejector 48 are in another category of water circuit. Thus, rinse water from the silver ion water solution producing device 4 is supplied according to the aforementioned water inlet timer 20 to the aforementioned other water circuit after treatment. Through the aforementioned combination, the silver ion water solution producing device 4 need only have a small capacity, so that it is easily built into the dental chair unit 25, and the silver ion water solution can be efficiently used.

[0024]

[Effect] The following kinds of excellent effects can be realized with this invention. The cumulative effects of sterilizing the residual water in the water circuits, preventing rust, degradation, and deformation of the water circuits, and deodorizing the water circuits, etc. can be achieved with a simple mechanism. In devices equipped with a water circuit switching controller, which switches between tap water and rinse water from the silver ion water solution producing device, rinse water can always be supplied to water circuits that use small quantities of rinse water, and tap water can always be supplied to water circuits that use large quantities of water, supplying the aforementioned silver ion water solution rinse water to them only at set times after treatment, thereby efficiently using the rinse water.

[Brief Explanation of the Figures]

[Figure 1] Magnified external view drawing of an antibacterial granule.

[Figure 2] External oblique view drawing of the silver ion water solution producing device in the de3ntal treatment device of this invention, viewed through the front panel.

[Figure 3] External view drawing of a dental chair unit in which the silver ion water solution production device of this invention has been installed.

[Figure 4] External view drawing of a handpiece with water jet.

[Figure 5] External view drawing of a water circuit switching controller installed in a silver ion water solution producing device.

[Figure 6] Block diagram in which silver ion water solution rinse water is used in all the water circuits of a dental chair unit.

[Figure 7] Block diagram in which a water circuit switching controller is installed in a silver ion water solution producing device.

[Legend]

1 : antibacterial granule
2 : spherical medium
3 : inorganic antibacterial powder
4 : silver ion water solution producing device
5 : antibacterial granule containing vessel
6 : vessel side mesh
7 : vessel tank
8 : vessel handle
9 : silver ion water solution
10 : producing device
11 : container removal port
12 : feed pipe
13 : device frame
14 : tap water inlet pipe
14a: solenoid valve
14b: open/close switch
15 : tap water inlet pipe
16 : water circuit switching controller
17, 18 : circuit display lamp
19 : switch knob
20 : inlet timer
21 : controller box
22 : feed pipe
23 : connecting pipe
24 : ball float
25 : dental chair unit
26 : chair
27 : bracket table
28 : main-side instrument group
29 : sub-side instrument group
30 : spit sink
31 : cup supply pipe
31a-33a : solenoid valve
31b-33b ; open/close switch
32 : spit sink rinse pipe
33 : hydrocolloid supply pipe
34 : base
35 : footswitch
36 : light
37 : handpiece with water jet
38 : water jet
39 : rotary drill
40 : silver ion water solution producing device container box
41 : water supply pump
42 : suction pump
43 : cup water supply
44 : spit sink
45 : three-way syringe
45a-52a : solenoid valve
45b-52b : open/close switch
47 : vacuum syringe
48 : saliva extractor
49 : scaler
50 : micromotor handpiece
51, 52 : air turbine handpiece

53 : main-side handpiece waste water circuit 54 : sub-side handpiece waste water circuit

55 : main drain pipe 56 : sub-side

57 : main-side 58 : setup log sheet

59 : filter 60 : waste water tank

61 : water suction vessel 62 : waste water vessel

[Figures]

[Translator's note: The first page of the translator's copy contained an overview of the following information and was omitted from the translation as redundant.]

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(57) [Abstract]
[Purpose] To reliably and economically sterilize water, etc.
[Constitution] An antibacterial granule 1 is constituted by adhering an inorganic antibacterial powder 3 to the surface of a granular substrate 2.

[Claims]
[Claim 1] An antibacterial granule characterized by being made from a granular substrate and an in organic antibacterial powder that is adhered to the surface of said substrate.

Detailed Description

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] This invention pertains to an antibacterial granule that contains an inorganic antibacterial powder.

[0002]

[Prior Art] The hot and humid weather in Japan facilitates the propagation of microorganisms and bacteria that spoil food and water, as well as microorganisms and bacteria that damage industrial materials and industrial goods. A variety of antibacterial agents have been developed and implemented to prevent the propagation of such microorganisms and bacteria. Primarily, organic antibacterial agents have been used in the past as this type of antibacterial agent, and have the advantages of being easily mixed into plastics, etc. and of being easily processed. However, these antibacterials also generally have the disadvantage that their antibacterial effect diminishes with the passage of time.

[0003] Meanwhile, inorganic antibacterial agents have been developed in recent years whose antibacterial effect lasts for long periods (Japan Kokoku Patent Publication Nos. S61-22977, S63-28402, S63-54013, H01-32254, etc.). This type of antibacterial agent is constituted from a solid powder of zeolite, a type of ceramic, which is then used by being kneaded into synthetic resin and used in synthetic leather shoes, etc. This type of inorganic antibacterial powder can also be used in toothpaste to prevent the propagation of E. coli, salmonella, and black mold, etc., and to suppress the propagation of bacteria that cause cavities, etc., or it can be used in the insoles, etc. of shoes to suppress the propagation of trichophyton, and it can further be used in bags for covering fruit in fruit orchards to kill the microorganisms that attach to the fruit.

[0004] Incidentally, because they are made from the aforementioned solid zeolite powder, etc., inorganic antibacterial powders have further advantages of having minimal toxicity, of their antibacterial properties lasting a long time, of acting on a wide variety of microorganisms and bacteria, and further of having superior heat resistance and weather resistance. However, when this type of inorganic antibacterial powder is used, e.g., when putting antibacterial properties into a synthetic resin molded good, it is kneaded into the base resin at a set proportion and then injection molded. Meanwhile, there is also a demand for preventing the propagation of bacteria and molds, etc. and maintaining water freshness in the water cleaners for swimming pools, etc. and the water tanks on ships and boats that will be traveling at sea for long periods, etc.

[0005]

[Problems to be Solved by the Invention] Currently, chlorine or ozone is used to disinfect water in order to maintain water freshness in water tanks and swimming pools, etc. but toxicity to humans is indicated with these disinfectants. The use of the aforementioned inorganic antibacterial powders has been considered as a countermeasure to such problems. However, since this type of antibacterial powder is a fine powder, as described above, it is undesirable to add it directly to a water tank as it would be ingested together with the water. Likewise, if it were added directly to a swimming pool, or the like, large amounts would be used since the water is constantly replaced, which is extremely uneconomical.

[0006] Mixing inorganic antibacterial powder into synthetic resin and placing the resulting molded good in the water has also been considered. However, since only the antibacterial agent located at the surface of the molded good would have any antibacterial action in this

case, it is likely that bacteria and/or mold, etc. would grow in the water tank, etc., within a few days. Focusing on the above points, the purpose of this invention is to provide an antibacterial granule that can reliably prevent the propagation of microorganisms and bacteria, particularly sterilize water, and with which the amount of antibacterial agent used is minimal.

[0007]

[Means of Solving Problems] This invention is an antibacterial granule made from a granular substrate and an inorganic antibacterial powder that is adhered to the surface of this substrate.

[0008]

[Action] Since the inorganic antibacterial powder is held on the surface of the substrate, it can be directly placed in the water tank or swimming pool by means of a containment means, such as a bag or the like. In addition, since the inorganic antibacterial powder is adhered to the surface of the substrate, the antibacterial properties are also excellent.

[0009]

[Example Embodiment] An example embodiment of this invention will be explained in detail below, referring to the attached figures. Figure 1 is a magnified view drawing that shows the antibacterial granule 1 of this invention. This antibacterial granule 1 is made from an inorganic antibacterial powder 3 that is adhered to the entire surface of this substrate 2. The substrate 2 is constituted from a transparent plastic (synthetic resin) with a grain size of approximately 3 to 5 mm. The inorganic antibacterial powder 3 is made from a solid powder zeolite, with a mean grain size of 2 micrometers and specific gravity of 2.1 to 2.2. This inorganic antibacterial powder is adhered at a proportion of approximately 3 gm per 100 gm of substrate 2. The aforementioned solid zeolite powder can be held by, e.g., silver ion exchanging a natural or synthetic zeolite made from aluminosilicate.

[0010] The antibacterial granule 1 of this invention, possessing the aforementioned constitution, is manufactured as follows. Namely, a multiplicity of substrates 2 is placed in a mixer and the mixer is operated at a high speed. The substrates 2 are thus made to contact each other, generating heat and melting their surfaces. At the point at which the surfaces of the substrates are melted, an organic solvent, such as toluene, is added to the mixer as a melt promoter. A specified quantity of inorganic antibacterial power 3 is then added to the mixer, and the mixer is again operated at high speed. Because the surface of each substrate 2 is thus melted and the inorganic antibiotic powder 3 collides substrates 2 at high speed, the inorganic antibiotic powder 3 is nearly uniformly adhered to the surface of the substrates 2.

[0011] Next, antibacterial tests with the antibacterial granules of this invention will be described. First, E. coli and Pseudomonas aeruginosa were selected as the test specimens, which bacteria were cultured for 18 hours at 37°C in respective agar media, and then suspended in respective phosphoric acid buffer solutions. Meanwhile, suspensions were prepared each containing 10^8 cells/mL of these cultured cells and appropriately diluted. Shaken flask testing was then performed. Namely, four 200 mL triangular flasks, each containing 100 mL of phosphoric acid buffer solution, were charged with the antibacterial granules 1 of this invention to proportions of 0.025% and 0.05%, and the various previously prepared test bacteria suspensions were added to concentrations of 10^5 cells/mL, after which, the triangular flasks were shaken at 25°C±5°C and the bacteria populations

were measured over time.

[0012] Figure 2 is a graph showing the test results when E. coli was used as the test bacteria. The baseline population of E. coli was 9×10^6 cells/mL, but when 0.025% of the antibacterial granule 1 of this invention were added, the population was 2.8×10^2 cells/mL when measured after 1 hour had passed, and "0" after 3 hours had passed. Further, when 0.05% of the antibacterial granule 1 of this invention were added, the population was 1.8×10^2 cells/mL when measured after 1 hour had passed, and "0" after 3 hours had passed. In contrast, the population of E. coli in a triangular flax to which the antibacterial granule of this invention was not added was 4.2×10^6 cells/mL after 1 hour had passed and 4.0×10^6 cells/mL after 3 hours had passed.

[0013] Meanwhile, Figure 3 is a graph showing the test results when P. aeruginosa was used as the test bacteria. The baseline population of P. aeruginosa was 1.8×10^6 cells/mL. When 0.025% of the antibacterial granule 1 of this invention were added, the population was 1.1×10^3 cells/mL when measured after 1 hour had passed, and "0" after 3 hours had passed. Further, when 0.05% of the antibacterial granule 1 of this invention were added, the population was 9.7×10 cells/mL when measured after 1 hour had passed, and "0" after 3 hours had passed. In contrast, the population of P. aeruginosa in a triangular flax to which the antibacterial granule of this invention was not added was 1.2×10^6 cells/mL after 1 hour had passed and 1.7×10^6 cells/mL after 3 hours had passed.

[0014] [Trial Example 1] As shown in Figure 4, 57 liters of tap water 5 were placed in a container 4 and a commercially available bag 6 was filled with 50 gm of the antibacterial granule 1 of this invention, and this bag 6 was placed in a container 4. When 1 mL of sample water was drawn from the container 4 after 10 days and the bacteria population (drop) was measured, it was "0". This trial was continued for 60 days, but the sterile condition was maintained. For comparison, when only 57 liters of tap water 5 was placed in a container 4 and left, 22 bacteria per 1 mL were detected on the third day since the chlorine in the tap water had evaporated. Subsequently, 1.5×10^5 bacteria per 1 mL were detected on day 10, 7.2×10^5 were detected on day 20, 5.3×10^5 were detected on day 30, 6.4×10^5 were detected on day 40, 8.9×10^5 were detected on day 50, and 3.7×10^5 were detected on day 60.

[0015] [Trial Example 2] 10 gm of the antibacterial granule of this invention were placed in a goldfish tank filled with approximately 50 liters of water. There were 4 goldfish. Thus, the water had to be changed only about every two weeks. In the past, it was necessary to change the water every week. Consequently, it is possible to improve the survival rate when shipping live fish.

[0016] The antibacterial granule 1 of this invention can be employed in other water treatment, e.g., it can be used to sterilize swimming pools, sterilize wells, to treat sewage, to prevent the growth of algae, and for antibacterial and anti-mold treatment in water coolers, to maintain the freshness of potable water on ships, etc., and for anti-mold treatment of bathwater. In addition, water sterilized with the antibacterial granule 1 of this invention can also be sprayed on vegetables. In this case, since sterile metal ions are solved out into the water, the water itself has antibacterial properties, making it possible to maintain the freshness of the vegetables for long periods.

[0017] Glass and a variety of metals and inorganic substances can be use as the substrate 2 in the above example embodiments, its shape can be selected from a variety of shapes, such as cylindrical or conical, etc., in which case, the inorganic antibacterial powder may be

adhered using a variety of adhesives. In addition, the antibacterial granule 1 of this invention can be used placed inside a water- or air-permeable bag, as well as a mesh container, etc.

[0018]

[Effect of the Invention] Since an antibacterial granule is constituted according to this invention by adhering an inorganic antibacterial powder to the surface of a granular substrate, as described above, antibacterial properties can be markedly improved, water can be sterilized and the propagation of microorganisms, etc. can be reliably prevented. In addition, since it can be utilized accommodated inside a bag, etc., small quantities of antibacterial agent are adequate for use, making it extremely economical.

[*Translator's note: Only one figure was provided in the translator's copy.*]

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

[END]